VP-60 ATTACK ANGLES, EFFORT AND DEPTH OF CUT

Attack Angle is the acute angle between the cutting edge of the iron and the plane sole. Different woods, grains and situations require different attack angles.

The attack angle of the VP-60 begins with the frog pitch. ***If the iron bevel is down, the attack angle will always equal the frog pitch.*** When using the VP-60, we recommend the iron bevel-down configuration for all attack angles between 30º to 60º (*the VP-60 was specifically designed with this recommendation in mind*).

For attack angles greater than 60º, the iron bevel must be up. To accurately determine the attack angle of a bevel-up iron, you must know the sum of the primary and micro-bevels. It is common for cutting edges to consist of a 25º primary grind with a honed 5º micro-bevel, creating a combined angle of 30º. *This is the cutting geometry we recommend for most VP-60 users.* This sum will always be *added* to the frog pitch to determine your attack angle. For example, to convert the VP-60 to a 90º scraper plane; if your primary and secondary bevels total 30º (*per the example above*), you would set the frog to 60º and insert the iron bevel-up into the VP-60…30º plus 60º = 90º.

The effort required to operate any plane begins with a razor sharp iron. ***As a reference, you can assume your iron is sharp when it will easily pass through the edge of newsprint*** *(similar to a cut made with scissors)****.***

Once your iron is sharp, a non-linear relationship exists between the *attack angle* and *effort*. As the attack angle increases, effort multiplies assuming the same depth of cut. Consequently, ***as the attack angle increases, depth of cut must decrease*** or the plane will be next to impossible to use. For example, a hardwood shaving .003" thick with an attack angle of 40º is fairly common. Combining this depth of cut with an attack angle of 90º will simply not work. Finally, there is also a relationship between attack angle and edge longevity—the higher the attack angle, the greater the resistance and heat, therefore shortening edge life.

Depth of cut is subjective and primarily determined by the material (*assuming the iron is sharp*). With practice, you will learn the proper depth of cut for various angles of attack in different woods until it is almost second nature.

VP-60 ATTACK ANGLE RECOMMENDATIONS

We offer the following general guidelines for various VP-60 angles of attack;

30° Super Low-Angle Plane: **30° Frog Pitch/Iron Bevel DOWN**

This setting is for advanced users only—those that can precisely control the cutting geometry of the iron. The VP-60 iron was factory ground with a 25° primary bevel and a 4 degree micro bevel for a combined 29° angle. This creates only 1° of clearance at this pitch. At this angle, the iron must be razor sharp, or it tends to "skip" over the wood, similar to skipping a stone on water. In addition, at this low angle, the adjustable pressure bar will not fully extend to the end of the blade, making this setting most suitable for softer woods. *Note: If the VP-60 iron has been sharpened many times the shoulder of the iron will no longer engage the lateral adjustment wheels. Lateral adjustments can be done manually or a replacement iron can be purchased.*

37° Low-Angle Plane: **Frog Pitch: 37° Iron Bevel: DOWN**

This is the most common attack angle for cutting end grain. We recommended trying this attack angle for trimming the end grain of joinery and for edge or face grain of most softwoods.

40° Mid-Low-Angle Plane: **Frog Pitch: 40° Iron Bevel: DOWN**

This is a good setting for straight-grain hardwoods. Really fine shavings are possible (*.0015"-.0025"*) with less effort than the more common bench plane attack angles.

45° Common Bench Plane: **Frog Pitch: 45° Iron Bevel: DOWN**

More bench planes have been made with this pitch than any other plane. 45° is an ideal, all-purpose setting for the VP-60.

50° York Plane: **Frog Pitch: 50° Iron Bevel: DOWN**

Many of the finer European planes employ a 50° attack angle. This is preferred by many as the ideal general purpose attack angle for common hardwoods.

55° Middle-Pitch Plane: **Frog Pitch: 55° Iron Bevel: DOWN**

As the grain in hardwoods becomes more beautiful, it also becomes more difficult. Fiddleback grain, some burly wood and other works of Mother Nature require a higher pitch to avoid ripping the grain from the surface.

60° Half-Pitch Plane: **Frog Pitch: 60° Iron Bevel: DOWN**

If the Middle Pitch setting yields unsatisfactory results, an additional 5° may be all that is necessary for successful work. At this setting the resistance increase is noticeable—a sharp iron and lighter cuts per pass are required.

61°- 90° Scraper Planes: **Frog Pitch: 31°- 60° Iron Bevel: UP**

Generally, any attack angle above 60º tends to be more of a “scrape” cut than a shearing cut. When nothing else will give you clean results, your answer lies within this range—particularly with crotch wood, curly maple, bird's-eye, knotty wood, most burls and many exotic woods. Depth of cut will be very light—at 90º you will get feather light, dusty curls with a sharp iron and dust (maybe) with a dull iron. Please note, a 90 degree attack angle is a true “scrape”—the VP-60 does not cut like a hand scraper, cabinet scraper or a dedicated scraper plane as there is no “hook” on the end of the iron. Therefore the cuts with the VP-60 will not be as aggressive. These higher settings are excellent attack angles for scraping defects from a surface finish (*brush marks, dust inclusions, etc.*) and other similar applications where you need to keep the surface integrity intact. Cutting resistance is maximized so edge life can be short.

THROAT OPENING GUIDELINES

The VP-60 throat opening is created from adjustable front and rear throat plates which are repositioned as the attack angle changes. For most users, understanding the role of the front of the throat is paramount for optimal results. For many users, *the rear throat of the VP-60 may never be changed*.

The gap between the leading edge of the iron and the front throat plate is the throat opening, adjusted primarily to reduce grain tear by limiting shaving thickness. Obviously, the throat must be as wide as the thinnest shaving you intend to create. Generally speaking, for fine shavings and a more satisfactory experience, we initially recommend adjusting the front throat of the VP-60 to 1.5 - 2 times the thickness of the thickest shaving you will make in a session. If you plan on making shavings no thicker than .003", begin by opening the throat to .005". This may seem difficult to do “by eye”, but it quickly becomes second nature and is surprisingly fast and precise. Most woodworkers set throat clearance by eye and some use homemade paper “gauges”. Regardless of the technique, you will quickly get the proper feel for what works.

A throat opening that is too narrow for the depth of cut causes shavings to jam in the throat and the VP-60 will cease cutting until the throat is cleared. A large throat opening is less problematic and often works with an increased risk of grain tear-out which can be mitigated by closing the throat.

The rear throat opening is adjustable for specific low attack angle applications (*<40º*) and the length of the material to be cut is shorter than the gap immediately behind the iron. For example, imagine a short, end-grain portion of a joint protruding from a flat surface (*i.e., through tenon*). With the VP-60 appropriately set-up as a 37.5 degree low-angle plane, it may take several passes to flush-trim the protruding end-grain. If the rear throat is not closed, the remainder of the offending material will protrude into the rear throat cavity. Your continued forward motion will create a collision between the protrusion and the back of the throat, possibly ruining your work. The cure is to move the rear throat plate forward creating a gap directly behind the iron that is shorter than the material to be cut. As previously mentioned, many VP-60 users may never have a need to adjust the rear throat.

The six screws that affix each throat plate to the sole are positioned such that at any setting, a minimum of four of the screws are correctly positioned in order to tighten the plate to the sole. DO NOT OVERTIGHTEN THESE SCREWS, VERY LITTLE TIGHTENING PRESSURE IS SUFFICIENT TO KEEP THE THROAT FLUSH WITH THE SOLE.

THE PRESSURE BAR AND DAMPENER

Because the adjustable frog pivots around a fixed point, the relationship of the iron cutting edge and the articulated iron cap varies as the pitch changes. The articulated iron cap adapts to all pitch settings and the telescopic pressure located on the end of the articulated iron cap provides a way for you to minimize the cantilever of the cutting edge.

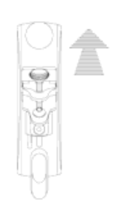
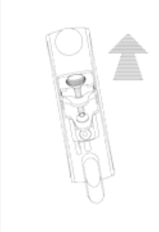
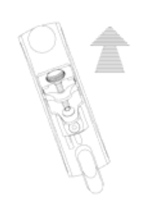
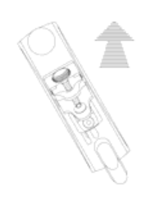
There is much debate regarding the role of the “chip breaker” in Western style planes. This debate centers on the concern that a shaving can act as a lever and pry loose ahead of the iron. We do not intend to enter this debate but will offer two observations. First, many premium Japanese smoothing planes do not have a chip breaker. And shavings 003" thick or less, made with a properly adjusted front throat are highly unlikely to act as a lever. Although one could refer to the pressure bar as a chip breaker (*it does force shavings to curl*), it is appropriately named.

We recommend adjusting the pressure bar to lie within 1/32" of the cutting edge. When the iron cap is tightened two things happen; the dampener contacts the iron behind the frog pivot point and the chip breaker is thrown forward, adding tension to the iron ahead of the dampener contact line. This creates a downward force on the iron that is greater than the downward force created by the resistance of the wood. The mass of the dampener helps deaden vibration and creates a fulcrum that alters the vibration characteristics of the iron, both of which help to minimize chatter. Over a short period of use, you will quickly become accustomed to this fast and easy adjustment.

SKEWING THE PLANE

Skewing a hand plane changes the effective attack angle. The first column of the chart below varies the attack angle of the VP-60 by five degree increments. Reading to the right, you can see how the attack angle changes as the skew angle increases.

Skewing the plane creates more of a shearing cut, lowers resistance and is often the only way to successfully plane some woods.

	PLANE SKEW					
	0°	10°	20°	30°	40°	50°
						
ACTUAL ATTACK ANGLE	90	*90.0*	*90.0*	*90.0*	*90.0*	*90.0*
	85	*84.9*	*84.7*	*84.2*	*83.5*	*82.3*
	80	*79.9*	*79.4*	*78.5*	*77.0*	*74.6*
	75	*74.8*	*74.1*	*72.8*	*70.7*	*67.4*
	70	*69.7*	*68.8*	*67.2*	*64.6*	*60.5*
	65	*64.7*	*63.6*	*61.7*	*58.7*	*54.0*
	60	*59.6*	*58.4*	*56.3*	*53.0*	*48.1*
	55	*54.6*	*53.3*	*51.0*	*47.6*	*42.6*
	50	*49.6*	*48.2*	*45.9*	*42.4*	*37.5*
	45	*44.6*	*43.2*	*40.9*	*37.5*	*32.7*
	40	*39.6*	*38.3*	*36.0*	*32.7*	*28.3*
	35	*34.6*	*33.3*	*31.2*	*28.2*	*24.2*
	30	*29.6*	*28.5*	*26.6*	*23.9*	*20.4*

🟧	*Effective iron attack angles (pitch) for difficult grain*
🟩	*Effective iron attack angles for general purpose work*
🟨	*Effective iron attack angles for cutting end-grain*

EXAMPLE: ***With the frog pitched to 40º (third row from the bottom in the above chart), iron bevel up, skewing the plane 30º changes the attack angle from 40º to 36º.***

FURTHER QUESTIONS AND COMMENTS?

We welcome further inquiries regarding the VP-60. Please email your comments and questions to:

sales@bridgecitytools.com

We will do our best to post the appropriate response to the VP-60 FAQ section within two business days.

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